cooperative action of a plurality of subsystems that act as a client apparatus, such as the motor control ECU 322, the reactive gas supply control ECU 323, the electrical power distribution control ECU 324, and the cell voltage detection control ECU 325.

Here, each of the ECUs 322, ..., 325 that form each subsystem carry out control for I/O processing for control signals sent and received between the cooperative control ECU 321 and the controlled objects and the shut down and protective operations during the occurrence of an abnormality such as a network stoppage, and based on the control signal obtained by the I/O processing of each of the ECUs 322, ..., 325, carries out the control operations for controlling each of the ECUs 322, ..., 325.

As shown in Fig. 3, for example, the cooperative control ECU 321 is formed comprising an MPU 361, a communication controller 362, and a program writing control unit 363.

The MPU 361 receives each of the control signals after I/O processing from each of the ECUs 322, ..., 325 that act as a plurality of subsystems via the communication controller 362, and carries out the control operations for cooperatively operating each of the ECUs 322, ..., 325 based on these control signals. Furthermore, the MPU 361 determines whether or not the communication with the network 151 ~~connected to the communication controller 362~~ is operating normally, and at the same time, detects communication traffic, and based on the results of these determinations and the results of the detection, carries out switching control of the communication paths as will be described below.

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In addition, the program writing control unit 363 controls the writing operation when the content or the like of the cooperative operation of each of the ECUs 322, ..., 325 is modified or the appropriate program writing apparatus 365 modifies the operation control of the MPU 361 externally.

communication system, the amount of partitioning of the data can be adjusted even between the normally operating communication systems, and can be set so that the communication traffic in each of the communicating systems will flow smoothly. Thereby, for example, delays in the transmission of data and the like due to the communication traffic of a particular communication system increasing excessively can be prevented.

Moreover, in the present embodiment, when the communication path of the first data 380a is switched from a communication system 381 on which an abnormality has occurred to a normally operating communication system 381 or 383, in the normally operating communication systems 382 and 383, the communication traffic is set so as to flow smoothly, but it is not limited thereby, and for example, can be set so as to cause an unbalance in the communication traffic in each of the communication systems 382 and 383, or, for example, can be set so that the communication traffic in any of the communication systems will increase. In sum, when switching the communication path of the data from a communication system on which an abnormality has occurred to a normally operating communication system, it can be set so that transmission delays and the like due to the communication traffic excessively increasing do not exceed a predetermined permitted range. Moreover, the adjustment of the communication traffic in each of the communication systems 381, 382, and 383 can reflect the predetermined distribution rate set in advance, and for example, distributed such that the current communication traffic is detected and allocated so as not to exceed a predetermined threshold.

In addition, in the present embodiment, the three cooperative control side communication ports 321A, 321B and 321C are connected to ~~the communication controller 362 of~~ the cooperative control ECU 321, but it is not limited thereby, and can

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be connected to four or more cooperative control side communication ports. For example, like the vehicle control system 390 according to the modified example of the present embodiment shown in Fig. 14, the two cooperative control side communication ports 321A and 321B can be connected.

In the vehicle control system 390 according to the modified example of the present embodiment shown in ~~Fig. 19~~ Fig. 14, the two redundant cooperative control side communication ports 321A and 321B are connected to the ~~communication controller 362 of the~~ cooperative control ECU 321.

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In addition, a plurality (for example, two each) of redundant communication ports 391A and 391B and communication ports 392A and 392B are respectively connected to each of the communication controllers 372 of the plurality (for example, two) of the first and second ECUs 391 and 392 that act as subsystems.

In addition, in the communication system 393 for example, one communication port 391A of the first ECU 391 is connected via the communication path 393M to the first cooperative control side communication port 321A of the cooperative control ECU 321, while one communications port 392A of the second ECU 392 is connected via the communication path 393S.

Furthermore, in the communication system 394, the other communication port 392B of the second ECU 392 is connected via the communication path 394M to the second cooperative control side communication port 321B of the cooperative control ECU 321, while the other communication port of the first ECU 391B is connected via the communication path 394S.

Moreover, in Table 2, a summary of the communication paths selected respectively during the normal operation and when damage has occurred on network 151 and the data that is sent and received is shown.

cooperative action of a plurality of subsystems that act as a client apparatus, such as the motor control ECU 322, the reactive gas supply control ECU 323, the electrical power distribution control ECU 324, and the cell voltage detection control ECU 325.

Here, each of the ECUs 322, ..., 325 that form each subsystem carry out control for I/O processing for control signals sent and received between the cooperative control ECU 321 and the controlled objects and the shut down and protective operations during the occurrence of an abnormality such as a network stoppage, and based on the control signal obtained by the I/O processing of each of the ECUs 322, ..., 325, carries out the control operations for controlling each of the ECUs 322, ..., 325.

As shown in Fig. 3, for example, the cooperative control ECU 321 is formed comprising an MPU 361, a communication controller 362, and a program writing control unit 363.

The MPU 361 receives each of the control signals after I/O processing from each of the ECUs 322, ..., 325 that act as a plurality of subsystems via the communication controller 362, and carries out the control operations for cooperatively operating each of the ECUs 322, ..., 325 based on these control signals. Furthermore, the MPU 361 determines whether or not the communication with the network 151 ~~connected to the communication controller 362~~ is operating normally, and at the same time, detects communication traffic, and based on the results of these determinations and the results of the detection, carries out switching control of the communication paths as will be described below.

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In addition, the program writing control unit 363 controls the writing operation when the content or the like of the cooperative operation of each of the ECUs 322, ..., 325 is modified or the appropriate program writing apparatus 365 modifies the operation control of the MPU 361 externally.

communication system, the amount of partitioning of the data can be adjusted even between the normally operating communication systems, and can be set so that the communication traffic in each of the communicating systems will flow smoothly. Thereby, for example, delays in the transmission of data and the like due to the communication traffic of a particular communication system increasing excessively can be prevented.

Moreover, in the present embodiment, when the communication path of the first data 380a is switched from a communication system 381 on which an abnormality has occurred to a normally operating communication system 381 or 383, in the normally operating communication systems 382 and 383, the communication traffic is set so as to flow smoothly, but it is not limited thereby, and for example, can be set so as to cause an unbalance in the communication traffic in each of the communication systems 382 and 383, or, for example, can be set so that the communication traffic in any of the communication systems will increase. In sum, when switching the communication path of the data from a communication system on which an abnormality has occurred to a normally operating communication system, it can be set so that transmission delays and the like due to the communication traffic excessively increasing do not exceed a predetermined permitted range. Moreover, the adjustment of the communication traffic in each of the communication systems 381, 382, and 383 can reflect the predetermined distribution rate set in advance, and for example, distributed such that the current communication traffic is detected and allocated so as not to exceed a predetermined threshold.

In addition, in the present embodiment, the three cooperative control side communication ports 321A, 321B and 321C are connected to ~~the communication controller 362 of~~ the cooperative control ECU 321, but it is not limited thereby, and can

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be connected to four or more cooperative control side communication ports. For example, like the vehicle control system 390 according to the modified example of the present embodiment shown in Fig. 14, the two cooperative control side communication ports 321A and 321B can be connected.

In the vehicle control system 390 according to the modified example of the present embodiment shown in ~~Fig. 19~~ Fig. 14, the two redundant cooperative control side communication ports 321A and 321B are connected to the ~~communication controller 362 of the~~ cooperative control ECU 321.

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In addition, a plurality (for example, two each) of redundant communication ports 391A and 391B and communication ports 392A and 392B are respectively connected to each of the communication controllers 372 of the plurality (for example, two) of the first and second ECUs 391 and 392 that act as subsystems.

In addition, in the communication system 393 for example, one communication port 391A of the first ECU 391 is connected via the communication path 393M to the first cooperative control side communication port 321A of the cooperative control ECU 321, while one communications port 392A of the second ECU 392 is connected via the communication path 393S.

Furthermore, in the communication system 394, the other communication port 392B of the second ECU 392 is connected via the communication path 394M to the second cooperative control side communication port 321B of the cooperative control ECU 321, while the other communication port of the first ECU 391B is connected via the communication path 394S.

Moreover, in Table 2, a summary of the communication paths selected respectively during the normal operation and when damage has occurred on network 151 and the data that is sent and received is shown.